Oklahoma Math Day

November 16, 2016

Trigonometry

INSTRUCTIONS:

1. Do not begin the test until told to do so.
2. Calculators are not permitted.
3. Be sure to enter your name and high school code on the answer sheet.
4. Use a number 2 pencil to fill out your answer sheet.
5. Please remain in your seat until the time is called.

OU Math Day 2016

Trigonometry Test

(with answers on the last page)

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1. $\arccos(-1/2) = ?$

   (A) $\pi/6$ (B) $\pi/3$ (C) $-\pi/3$ (D) $5\pi/6$ (E) None of the above.

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2. If $\sin(x) = 1/5$ and $0 < x < \pi/2$, what is the value of $\sin(2x)$?

   (A) $2\sqrt{6}/25$ (B) $\sqrt{6}/25$ (C) $24/25$ (D) $4\sqrt{6}/25$ (E) None of the above.

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3. Which of the following functions is different from the others?

   (A) $y = \cos(x + \pi/6)$ (B) $y = -\sin(x - \pi/3)$ (C) $y = \sin(\pi/3 - x)$
   (D) $y = -\cos(5\pi/6 - x)$ (E) They are all the same.

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4. What is the value of $\cos(90^\circ)$?

   (A) -1 (B) $-1/2$ (C) 0 (D) 1 (E) None of the above.

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5. Solve for x given that $\sin(x)\cos(2x) = \sin(2x)$.

   (A) $\pi/2$ (B) $5\pi/6 + 2\pi n$ (C) $(1 + \sqrt{3})/2$ (D) $\pi/4$ (E) None of the above.

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6. A triangle has interior angles α, β and γ. If $3\sin\alpha + 4\cos\beta = 6$ and $4\sin\beta + 3\cos\alpha = 1$, what is the degree measure of γ?

(A) 30° (B) 45° (C) 60° (D) 150° (E) None of the above.

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7. What is the period of the function $f(x) = \sin(x) + \cos(x/2)$?

(A) π (B) 2π (C) 3π (D) 4π (E) None of the above.

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8. If $\sin(x) = \dfrac{1}{\sqrt{7}}$ then $\sec(x)$ equals

(A) $\sqrt{7}/\sqrt{6}$ (B) $6/7$ (C) $\sqrt{6}/\sqrt{7}$ (D) $\sqrt{7}$ (E) None of the above.

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9. The number of points of intersection between the graphs of $y = \sin(2x)$ and $y = x$ is?

(A) 0 (B) 1 (C) 2 (D) 3 (E) None of the above.

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10. Two sides of a triangle measure 8 and 12 units long, respectively. The angle between them measures 60 degrees. How long is the third side of the triangle, in units?

(A) $8\sqrt{3}$ (B) $4\sqrt{7}$ (C) $4\sqrt{13}$ (D) 16 (E) None of the above.

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11. Which of the following equals $\arctan(1) - \arctan(0)$?

(A) $5\pi/4$ (B) $\pi/4$ (C) $-\pi/4$ (D) $-3\pi/4$ (E) None of the above.

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12. Two points A and B lie on a circle and are not diametrically opposed. With a third point C on the circle they form the triangle ABC. How many such points C are there on the circle such that $\sin B = \frac{1}{2}$?

(A) 1 (B) 2 (C) either 1 or 2 (D) either 2 or 3 (E) None of the above.

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13. If x is any real number which of the listed statements is NOT true? (Assume that radian measure is used.)

(A) $\sec(-x) = \sec(x)$ (B) $\tan(-x) = -\tan(x)$ (C) $\sin(x + \pi) = -\sin(x)$
(D) $\cos(2x) = 2\cos^2(x) - 1$ (E) None of the above.

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14. If $\cos(\theta)$ is negative and $\tan(\theta)$ is negative, then in which quadrant does the terminal side of θ lie?

(A) I (B) II (C) III (D) IV (E) None of the above.

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15. Which of the following is equal to $\cos^4(x) - \sin^4(x)$?

(A) $\cos(2x)$ (B) $\cos(x)\sin(x)$ (C) 1 (D) $\sin(2x)$ (E) None of the above.

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16. A triangle has side lengths of 5, 12 and 13 units respectively for sides a, b, and c. If β is the angle between sides a and c, what is $\sec^2(\beta)$?

(A) 144/169 (B) 144/25 (C) 25/144 (D) 169/25 (E) None of the above.

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17. A function f is defined by $f(x) = \cos^2(x) + \sin(2x)$. What is $f(\pi/6)$?

(A) 3/4 (B) $(3 + 2\sqrt{3})/4$ (C) $(1 + 2\sqrt{3})/4$ (D) 5/4 (E) None of the above.

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18. If $\tan(\phi) = 8/7$ then what is the absolute value of $\sin(\phi)$?

(A) $\frac{7}{\sqrt{113}}$ (B) $\frac{113}{8}$ (C) $\frac{8}{\sqrt{113}}$ (D) $\frac{\sqrt{113}}{7}$ (E) None of the above.

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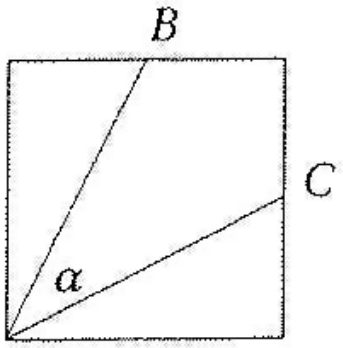
19. Let B and C be midpoints of the sides of a square and let α be the angle shown in the figure below. What does $\sin(\alpha)$ equal?

(A) 3/5 (B) 4/5 (C) 1/2 (D) $2/\sqrt{5}$ (E) None of the above.



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20. Simplify $\tan(\pi/4)\sin(11\pi/4)\cot(18\pi/4) + \sec(5\pi)\cos(\pi/6)\tan(7\pi/6)$

(A) $-1/(2\sqrt{3})$ (B) $-1/2$ (C) $-3/2$ (D) $1/2$ (E) None of the above.

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21. Which of the following numbers is the largest?

(A) $\sin(40^\circ)$ (B) $\sin(70^\circ)$ (C) $\sin(100^\circ)$ (D) $\sin(130^\circ)$ (E) $\sin(160^\circ)$

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22. Find the sum of all of the solutions to the equation

$$2\sin^2(x) - 2\sin^2(x)\cos(x) - \sin(x)\cos(x) + \sin(x) = 0$$

where x is in the interval $[0, 2\pi]$.

(A) 6π (B) 3π (C) $25\pi/6$ (D) 4π (E) None of the above.

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23. Suppose that $\tan\theta = \frac{12}{5}$ and that $0 < \theta < \pi/2$. What does $\sec\theta$ equal?

(A) $\dfrac{\sqrt{119}}{5}$ (B) $\dfrac{13}{5}$ (C) $\dfrac{\sqrt{5}}{12}$ (D) $\dfrac{13}{12}$ (E) None of the above.

Answers for the 2016 Trigonometry Test:

1-5:	EDECE
6-10:	ADADB
11-15:	BCEBA
16-20:	DBCAB
21:	CAB